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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/080,468	02/22/2002	Hua Ji	M-12589 US	8384

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EXAMINER

MAI, ANH D

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 05/20/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/080,468

Applicant(s)

JI, HUA

Examiner

Anh D. Mai

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 February 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 February 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

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DETAILED ACTION

Drawings

1. Figures 1-5 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-29 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The specification described a film deposition process including: "E/D ratios from 0.0 to about -0.05". The $E/D = (UBUC - BUC)/UBUC$

Where UBUC is deposition rate of with no bias; and BUC is deposition rate of with bias.

It is well known that, without bias, no etching component is present^{of} and with bias, there is an etching component. Therefore, the deposition rate of without bias (UBUC) is always larger than with bias (BUC).

The claimed invention, however, disclosed a negative E/D (- 0.05).

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The negative E/D means $BUC > UBUC$.

How can BUC be large than UBUC while there is an etching component involve ?

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-13 and 15-28 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Papasouliotis et al. (U.S. Patent No. 6,030,881).

With respect to claims 1 and 19, as best understood by the examiner, Papasouliotis teaches method for filling gaps during integrated circuit fabrication as claimed including:

providing a gas mixture comprised of silicon-containing and oxygen-containing components;

selecting a flow rate of the silicon-containing component;

minimizing a ratio of the oxygen-containing component to the silicon-containing component, wherein the minimized ratio allows formation of a film (525) comprising a selected stoichiometry; and

depositing the film (525) over the gaps (510) by using the gas mixture for simultaneous high density plasma chemical vapor deposition and sputter etching (HDP-CVD). (See Figs. 5A-C).

With respect to claims 2 and 5, the silicon-containing and oxygen-containing components of Papasouliotis comprises a concentration by volume of the gas mixture as claimed.

With respect to claims 3, 6, 20 and 22, the silicon-containing and oxygen-containing components of Papasouliotis is at a flow rate that includes claimed range.

With respect to claims 4 and 21, the silicon-containing component of Papasouliotis comprises silane.

With respect to claims 7 and 23, the oxygen-containing component of Papasouliotis comprises a O₂.

With respect to claims 8, 10, 24 and 26, the gas mixture of Papasouliotis is further includes an inert component, He.

With respect to claims 9 and 25, the inert component of Papasouliotis is at a flow rate that includes the claimed range.

With respect to claims 11, 12, 27 and 28, the minimized ratio of oxygen-containing component to silicon-containing component of Papasouliotis includes the claimed range.

With respect to claim 13, the gas mixture of Papasouliotis is at pressure that includes the claimed range.

With respect to claim 15, the film (525) of Papasouliotis comprises silicon oxide.

With respect to claim 16, the film (525) of Papasouliotis appears to comprises a refractive index as claimed.

With respect to claim 17, the process of Papasouliotis further comprises:

providing a low frequency power source operable to form plasma from the gas mixture,
the low frequency power source is providing power that includes the claimed range.

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With respect to claim 18, the process of Papasouliotis further comprises:
providing a high frequency power source operable to bias the substrate, the high frequency power source is providing power that includes the claimed range.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 14 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Papasouliotis '881.

As best understood by the examiner, Papasouliotis teaches depositing a film over a gap having high aspect ratio including etch/dep ratio is determined by:

$$E/D = (UBUC - BUC) / UBUC.$$

Thus, Papasouliotis is shown to teach all the features of the claim with the exception of explicitly disclosing the ratio as claimed.

However, since the deposition method of Papasouliotis includes depositing an oxide film in gap having an aspect ratio that greater than the present invention, thus, the E/D ratio of Papasouliotis should at least includes the claimed ratio to fill the gap without void.

Further, given the teaching of Papasouliotis, it would have been obvious to one having ordinary skill in the art, to determine the optimum etch-to-deposit ratio to fill a gap without

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voids.. See In re Aller, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".



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